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The Trichogramma (Hymenoptera: Trichogrammatidae) of Taiwan 【Research report】

臺灣產赤眼蜂屬(膜翅目：赤眼蜂科)之分類【研究報告】

Mei-Ling Chan Liang-Yih Chou*
詹美鈴 周樑鎰*

*通訊作者E-mail : chouly@wufeng.tari.gov.tw

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Abstract

Eight species of the genus Trichogramma Westwood (Hymenoptera: Trichogrammatidae) from Taiwan are redescribed or described and illustrated in this paper. Of the included species, T. choui and T. taiwanense are new to science, T. longxishanese Lin and T. raoi Nagaraja are new to Taiwan. A key to the all known species of Taiwanese Trichogramma is also presented.

摘要

赤眼蜂屬(Trichogramma)隸屬膜翅目、赤眼蜂科(Trichogrammatidae)，全世界已知之種類約150種以上，而臺灣僅記錄6種。本文記述臺灣產之8種赤眼蜂，其中T. choui 和T. taiwanense 為新種，T. longxishanense Lin 和T. raoi Nagaraja 為臺灣新記錄種。此外，並附臺灣產赤眼蜂屬已知種之檢索表。

Key words: Trichogrammatidae, Trichogramma, taxonomy, Taiwan, new species.
關鍵詞: 赤眼蜂科、赤眼蜂屬、分類、臺灣、新種、新記錄種

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The Trichogramma (Hymenoptera: Trichogrammatidae) of Taiwan

Mei-Ling Chan Department of Zoology, National Museum of Natural Science, Taichung, Taiwan 404, ROC.
Liang-Yih Chou* Department of Applied Zoology, Taiwan Agricultural Research Institute, Taichung, Taiwan 413, ROC.

ABSTRACT

Eight species of the genus Trichogramma Westwood (Hymenoptera: Trichogrammatidae) from Taiwan are redescribed or described and illustrated in this paper. Of the included species, T. choui and T. taiwanense are new to science, T. longxishanese Lin and T. raoi Nagaraja are new to Taiwan. A key to the all known species of Taiwanese Trichogramma is also presented.

Key words: Trichogrammatidae, Trichogramma, taxonomy, Taiwan, new species.

Introduction

It is very common to raise and release Trichogramma spp. in the field to reduce the population of pests in many countries, due to their parasitizing in pest eggs, especially lepidopterous eggs. Significantly, they are with economic importance in agricultural field, therefore the identification of species of Trichogramma is very important and required. So far, there are 7 species of Trichogramma in Taiwan, including T. psocopterae Chan & Chou and T. neuropterae Chan & Chou (Sonan, 1944; Yen, 1973; Chiu and Chen, 1986; Lin, 1994; Chan et al., 1997). However, the record of T. minutum Riley from Taiwan is doubtful. This study redescribes 6 species, and adds 2 new species T. choui and T. taiwanense, and 2 new records T. longxishanese Lin and T. raoi Nagaraja.

Descriptions, redescriptions, and illustrations of 8 species of Trichogramma, and the key for the Taiwanese species are provided. The description is based on killed specimens mounted in Hoyer's solution on glass slides. The terminology used describing the genitalia follows Pinto (1992). Unless otherwise stated the specimens used in this study were collected by K. C. Chou. The holotypes designated in this study are deposited at the Taiwan Agricultural Research Institute, Taichung, Taiwan. Paratypes and other specimens are preserved separately at the above institution and at the collection of Department of Zoology, National Museum of Natural Science, Taichung, Taiwan.

Key to species of the genus Trichogramma from Taiwan

1. DLA typically triangular or subtriangular, aedeagus not broad, with lateral margin not sinuated 2

*Correspondence address
e-mail:chouly@wufeng.tari.gov.tw

-. GC round and broad, DLA broad with posterior extension acutely emarginate apically; apodemes very short .... neuropterae Chan & Chou
2. DLA with prominent lateral lobes 3
-. DLA without prominent lateral lobes 4
3. DLA with narrowly rounded lateral lobes at base; antennal flagellum of male bearing less than 50 hairs; IVP broad extending to 0.38-0.44 AD .... chilonis Ishii
-. DLA with broadly rounded lateral lobes at base; antennal flagellum of male bearing more than 50 hairs; IVP extended to 0.56-0.67 AD .... dendrolimi Matsumura
4. IVP well developed, broad or long 5
-. IVP short or inconspicuous 7
5. IVP long and triangular, DLA moderately constricted at base .... ostriniae Pang & Chen
-. IVP broad, DLA not constricted at base 6
6. Body small; flagellum of male relatively short, similar to those of female, mandible with 3 teeth; genitalia with VS below level of PM, posterior ends of PM extremely pointed .... psocopterae Chan & Chou
-. Body large; flagellum of male 0.19-0.27 as wide as long; aedeagus triangular and broad, apodeme divergent to apex; IVP extremely broad and sclerotized ... . longxishanense Lin
7. DLA horseshoe shaped at base; IVP apparently absent; ovipositor extremely long, OL/HTL= 1.35-1.5 .... japonicum Ashmead
-. DLA not horseshoe shaped at base; IVP present or absent; OL/HTL less than 1.15..... 8
8. PM almost same level of VS, IVP minute but distinct .... choui n.sp.
- PM below level of VS 9
9. IVP inconspicuous; DLA weakly sclerotized; hind wing with anterior vein tract 0.5-0.65 .... raoi Nagaraja
-. IVP short but distinct, DLA hightly sclerotized, extending to 0.2-0.38 .... taiwanense n.sp.

Trichogramma chilonis Ishii (Figs. 1-8)

Trichogramma chilonis Ishii, 1941, Kontyû, 14:173. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 48.
Trichogramma australicum: Nagarkatti & Nagaraja, 1968: 81-96.
Trichogramma confusum Viggiani, 1976, Boll. Lab. Ent. Agric., Portici 33:182-183.

Male: Body length 0.57-0.79 mm, head width 0.23-0.33 mm, HTL 0.16-0.20 mm. Antenna: flagellum 0.15-0.19 times as wide as long, and slightly longer than HTL, 1.05-1.18 HTL; with 10 BCPS and 3 PS; flagellar setae long and sharply tapering, 44-50 in number, longest seta 2.39-2.81 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae short, about 0.25-0.28 length of posterior pair. Forewing: 0.47-0.60 mm, FWW/FWL= 0.48-0.52; longest fringe seta about 0.12-0.18 FWW; Rs1 with 3 to 7 setae, 9-32 setae between 4th and 5th vein track. Hindwing: anterior vein tract composed of 2-3 setae, extending more than 0.22-0.35 distance of middle tract, posterior vein tract with 6-10 setae, almost extending 0.39-0.52 of middle tract.

Genitalia: GC 0.47-0.59 as wide as long; AD 0.23-0.27 GL; length of DA 0.59-0.67 GL; DLA with prominant narrowly rounded lateral lobes, extending to 0.38-0.53 AD; VS far below level of tips of PM, occupying about 0.59-0.71 AD; IVP broad, 0.38-0.44 AD, entire region highly chitinized; IB narrow; VR paired, extending about 0.39-0.48 GL; VP not visible. Apodemes 0.5-0.55 AL. AL 0.97-1.07 GL and AL/HTL= 0.66-0.8.

Color: Body yellowish; pronotum, mesonotum and abdomen brownish.

Female: Body length 0.73-0.79 mm, head width 0.23-0.27 mm, HTL 0.17-0.19 mm. Antenna: club 0.48-0.52 broad as

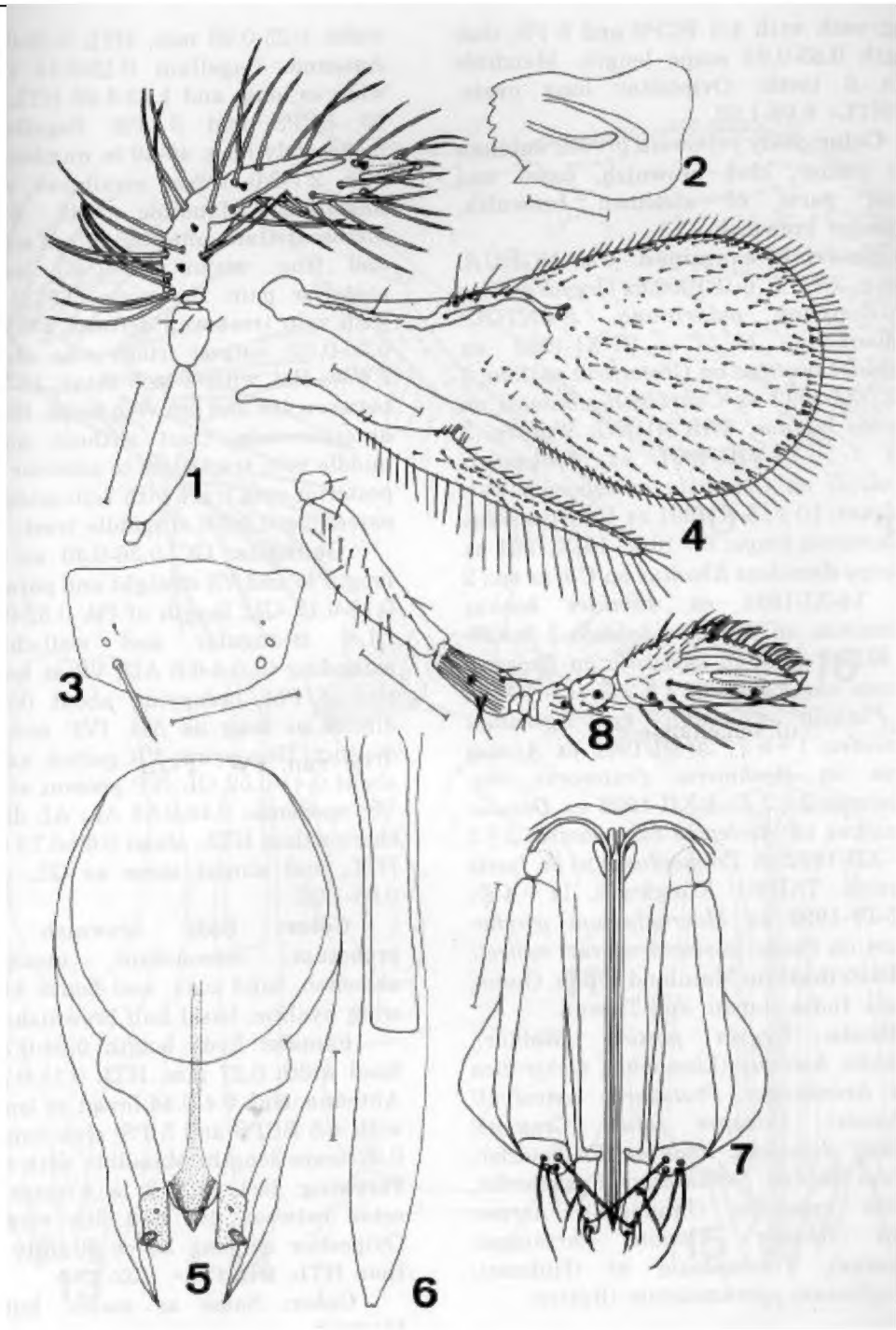

Fig.1-8. ***Trichogramma chilonis* Ishii:** 1-6, male; 7-8, female. 1, antenna; 2, mandible (dorsal view); 3, mesoscutellum (expanded); 4, wings; 5, genital capsule (dorsal view); 6, aedeagus (dorsal view); 7, ovipositor; 8, antenna (Scale: 2, 5, 6= 0.02 mm; 1, 3, 7, 8= 0.05 mm; 4= 0.1 mm).

long, each with 4-5 BCPS and 5 PS; club length 0.85-0.93 scape length. Mandible with 6 teeth. Ovipositor long ovate. OL/HTL = 0.98-1.03.

Color: Body yellowish brown; antenna pale yellow, club brownish, basal and apical parts of abdomen brownish, ovipositor brownish.

Materials examined: CHANGHUA: Tatsun, 2♀2♂, 6-II-1993 ex Orgyia postica on Zizyphus mauritiana. NANTOU: Peishankeng, 10♂, 27-XI-1992 ex Lampides boeticus on Crotararia pallida; 5♂, 27-XI-1992 ex Conrolvulus batatas on Ipomoea batatas. TAICHUNG: Wufeng, 2♀3♂, 17-VIII-1991 ex Protoparca convolvuli on Colocasia antiquorum var. esculenta; 10♂, 5-X-1991 ex Udaspes folus on Curcuma longa; 9♀10♂, 15-X-1991 ex Princeps demoleus libanius on Citrus sp.; 2♂, 14-XI-1991 ex Jamides bochus formosanus on Dolichos lablab; 1♀, 27-XI-1991 ex Plutella xylostella on Brassica oleracea var. capitata; 1♀2♂, 17-II-1992 ex Plutella xylostella on Ageratum conyzoides; 1♀8♂, 20-III-1992 ex Acraea issoria on Boehmeria frutescens var. frutescens; 2♀2♂, 4-XII-1992 ex Danaus chrysippus on Asclepias curassavica; 3♀3♂, 7-XII-1992 ex Trichoplusia ni on Ixeris chinensis. TAIPEI: Kungkuan, 11♀4♂, 24-25-IV-1992 ex Macroglossum pyrrhostictum on Paederia scandens var. mairei.

Distribution: Mainland China, Guam, Hawaii, India, Japan, and Taiwan.

Hosts: Orgyia postica (Walker), Lampides boeticus (Linnaeus), Ochyrotica yanoi Arenberger, Protoparca convolvuli (Linnaeus), Udaspes folus (Cramer), Princeps demoleus libanius Fruhstorfer, Jamides bochus formosanus Fruhstorfer, Plutella xylostella (Linnaeus), Acraea issoria (Hubner), Danaus chrysippus (Linnaeus), Trichoplusia ni (Hubner), Macroglossum pyrrhostictum (Butler).

Trichogramma choui n. sp. (Figs. 9-16)

Male: Body length 0.55-0.69 mm, head width 0.25-0.26 mm, HTL 0.15-0.18 mm. Antenna: flagellum 0.13-0.18 times as wide as long, and 1.13-1.26 HTL; with 9-10 BCPS and 3 PS; flagellar setae moderately long, 40-49 in number, longest seta 2.7-3.0 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae short and fine, about 0.19-0.25 length of posterior pair. Forewing: 0.51-0.53 mm, with vein tract well defined; FWW/FWL = 0.50-0.52; longest fringe seta about 0.15 FWW; Rs1 with 2 to 5 setae, 16-27 setae between 4th and 5th vein track. Hindwing: anterior vein tract without any seta, middle vein tract close to anterior margin, posterior vein tract with 7-10 setae, almost extending 0.3-0.6 of middle tract.

Genitalia: GC 0.36-0.40 as wide as long; PM and VS straight and parallel; AD 0.15-0.17 GL; length of DA 0.52-0.57 GL; DLA triangular and well-chitinized, extending to 0.4-0.6 AD; VS at level with tips of PM, occupying about 0.9-1 AD, almost as long as AD; IVP minute but distinct; IB narrow; VR paired, extending about 0.41-0.52 GL; VP present at base of VS; apodemes 0.48-0.53 AL. AL distinctly shorter than HTL, about 0.69-0.73 times of HTL, and almost same as GL, AL/GL = 0.95-1.05.

Color: Body brownish yellow; pronotum, mesonotum, mesopleurae, abdomen, hind coxa, and femur blackish; wing hyaline, basal half brownish.

Female: Body length 0.64-0.74 mm, head width 0.27 mm. HTL 0.15-0.21 mm. Antenna: club 0.4-0.44 broad as long, each with 4-5 BCPS and 5 PS; club length 0.9-0.97 scape length. Mandible with 6 teeth. Forewing: Rs1 with 2 to 4 setae, 13-27 setae between 4th and 5th vein tract. Ovipositor as long as or slightly longer than HTL, OL/HTL = 1.02-1.08.

Color: Same as males, but head blackish.

Materials examined: Holotype: ♂, TAICHUNG: Wufeng, 22-VI-1993 ex Lepidoptera on Asclepias curassavica.

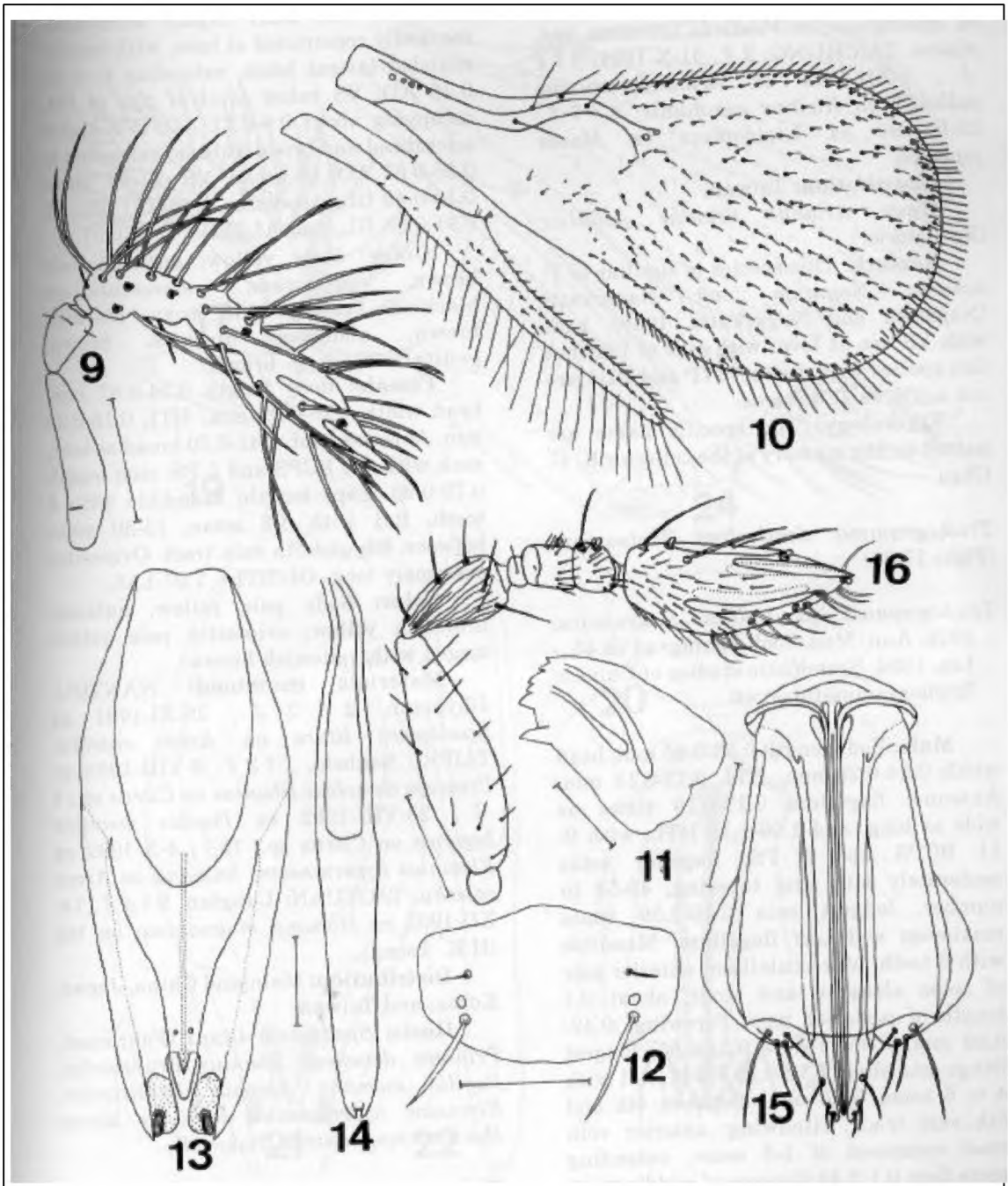

Fig.9-16. ***Trichogramma choui*** Chan & Chou n. sp.: 9-14, male; 15-16, female. 9, antenna; 10, wings; 11, mandible (dorsal view); 12, mesoscutellum (expanded); 13, genital capsule (dorsal view); 14, aedeagus (dorsal view); 15, ovipositor; 16, antenna. (Scale: 11, 13, 14= 0.02 mm; 9, 12, 15, 16= 0.05 mm; 10= 0.1 mm).

Paratypes: 5♀1♂ same as holotype; NANTOU: Wushe, 1♀6♂, 11-13-III-1992 ex Sphingidae on Paederia scandens var. mairei. TAICHUNG: 2♂, 31-X-1991; 3♀4♂, 1-XII-1991 ex Ariadne ariadne pallidior on Ricinus communis; 4♀7♂, 23-II-1992 ex Lepidoptera on Maesa japonica.

Distribution: Taiwan.

Host: Ariadne ariadne pallidior (Fruhstorfer).

Remark: This species is similiar to T. achaeae Nagaraja and Nagarkatti (Nagaraja and Nagarkatti, 1969), both with VS are at level with tips of PM, but this species with distinct IVP and DLA are not acute as T. achaeae.

Etymology: The specific name are named for the memory of the collector K. C. Chou.

Trichogramma dendrolimi Matsumura (Figs. 17-24)

Trichogramma dendrolimi Matsumura, 1926, Ann. Mus. Zool. Leningrad 26:45. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 46.

Male: Body length 0.53-0.85 mm, head width 0.24-0.28 mm, HTL 0.13-0.18 mm. Antenna: flagellum 0.17-0.19 times as wide as long, and 1.06-1.19 HTL; with 9-11 BCPS and 3 PS; flagellar setae moderately long and tapering, 49-58 in number, longest seta 2.16-2.39 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about 0.1 length of posterior pair. Forewing: 0.42-0.56 mm, FWW/FWL= 0.51-0.55; longest fringe seta about 0.12-0.19 FWW; Rs1 with 4 to 6 setae, 6-20 setae between 4th and 5th vein track. Hindwing: anterior vein tract composed of 1-3 setae, extending more than 0.1-0.49 distance of middle tract, posterior vein tract with 7-11 setae, extending 0.31-0.7 of middle tract.

Genitalia: GC 0.43-0.53 as wide as long; AD 0.24-0.28 GL; length of DA 0.59-0.66 GL; DLA highly sclerotized, markedly constricted at base, with broadly rounded lateral lobes, extending to 0.55-0.76 AD; VS below level of tips of PM, occupying about 0.6-0.71 AD; IVP highly sclerotized and broad at base, extending to 0.56-0.67 AD; IB broad; VR paired, about 0.13-0.49 GL; Apodemes 0.45-0.51 AL, AL 0.91-0.98 GL, and AL/HTL= 0.83-0.97.

Color: Body yellow; antenna pale brown, pronotum, mesoscutellum blackish brown, hind coxa blackish brown, abdomen blackish brown, genitalia blackish brown.

Female: Body length 0.74-0.87 mm, head width 0.26-0.29 mm, HTL 0.16-0.20 mm. Antenna: club 0.41-0.50 broad as long, each with 4-5 BCPS and 5 PS; club length 0.79-0.93 scape length. Mandible with 6 teeth. Rs1 with 5-8 setae, 15-30 setae between 4th and 5th vein tract. Ovipositor extremely long, OL/HTL= 1.07-1.16.

Color: Body pale yellow, antenna brownish yellow, ovipositor pale yellow tinged with yellowish brown.

Materials examined: NANTOU: Jihyuetan, 2♀3♂, 29-XI-1991 ex Spodoptera litura on Areca catechu. TAIPEI: Sanhsia, 1♀3♂, 8-VIII-1992 ex Princeps demoleus libanius on Citrus sp.; 1♂, 23-VIII-1992 ex Papilio memnon heronus on Citrus sp.; 15♀, 4-X-1992 ex Elymnias hypermnestra hainana on Areca catechu. TAOYUAN: Lungtan, 9♀4♂, 14-XII-1992 ex Homona magnanima on tea (H.K. Tseng).

Distribution: Mainland China, Japan, Korea, and Taiwan.

Hosts: Spodoptera litura (Fabricius), Princeps demoleus libanius Fruhstorfer, Papilio memnon heronus Fruhstorfer, Elymnias hypermnestra hainana Moore Homona magnanima Diakonoff.

Tichogramma japonicum Ashmead (Figs. 25-32)

Trichogramma japonicum Ashmead, 1904,

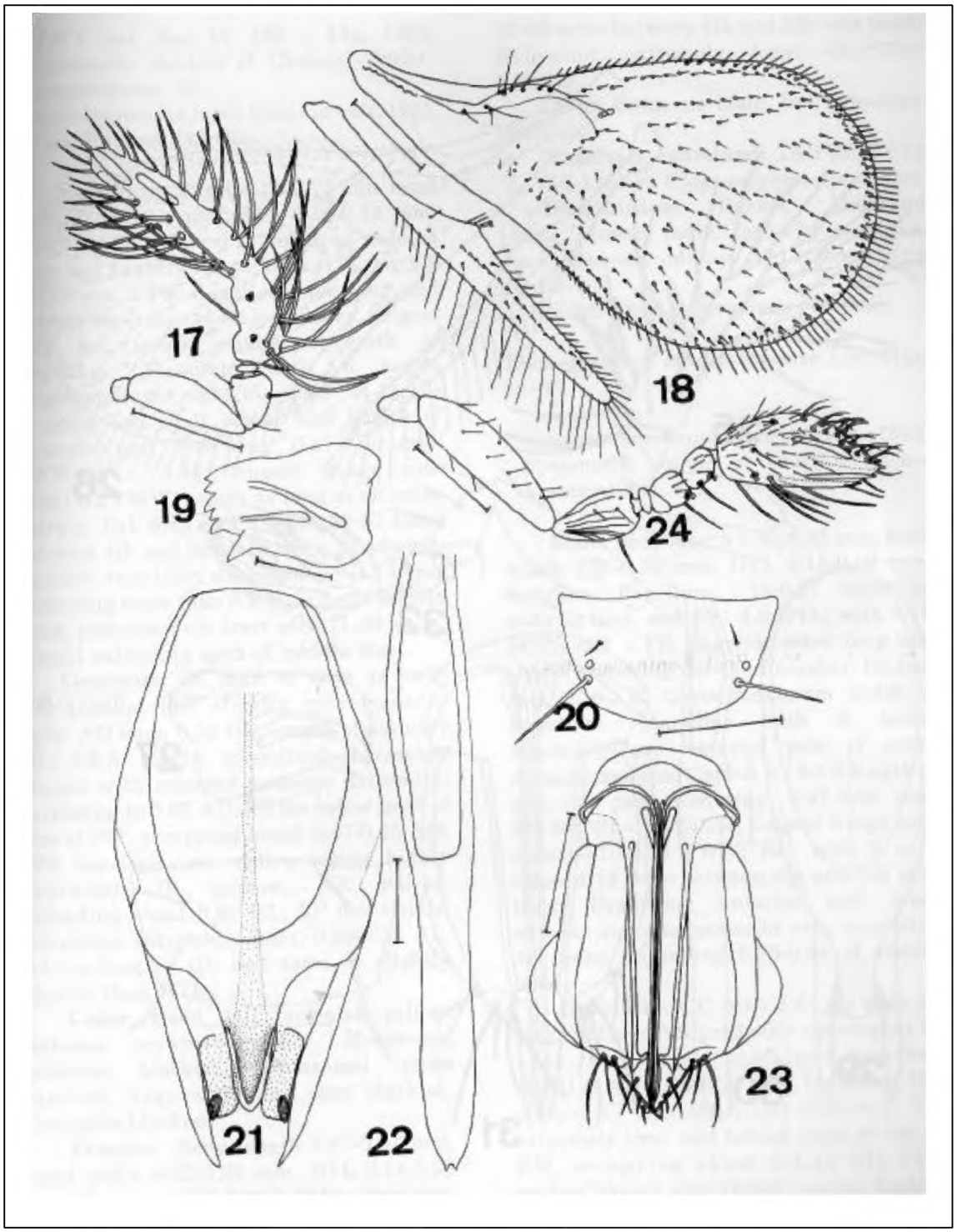

Fig.17-24. ***Trichogramma dendrolimi*** Matsumura: 17-22, male; 23-24, female. 17, antenna; 18, wings; 19, mandible (dorsal view); 20, mesoscutellum (expanded); 21, genital capsule (dorsal view); 22, aedeagus (dorsal view); 23, ovipositor; 24, antenna. (Scale: 19, 21, 22= 0.02 mm; 17, 20, 23, 24= 0.05 mm; 18= 0.1 mm).

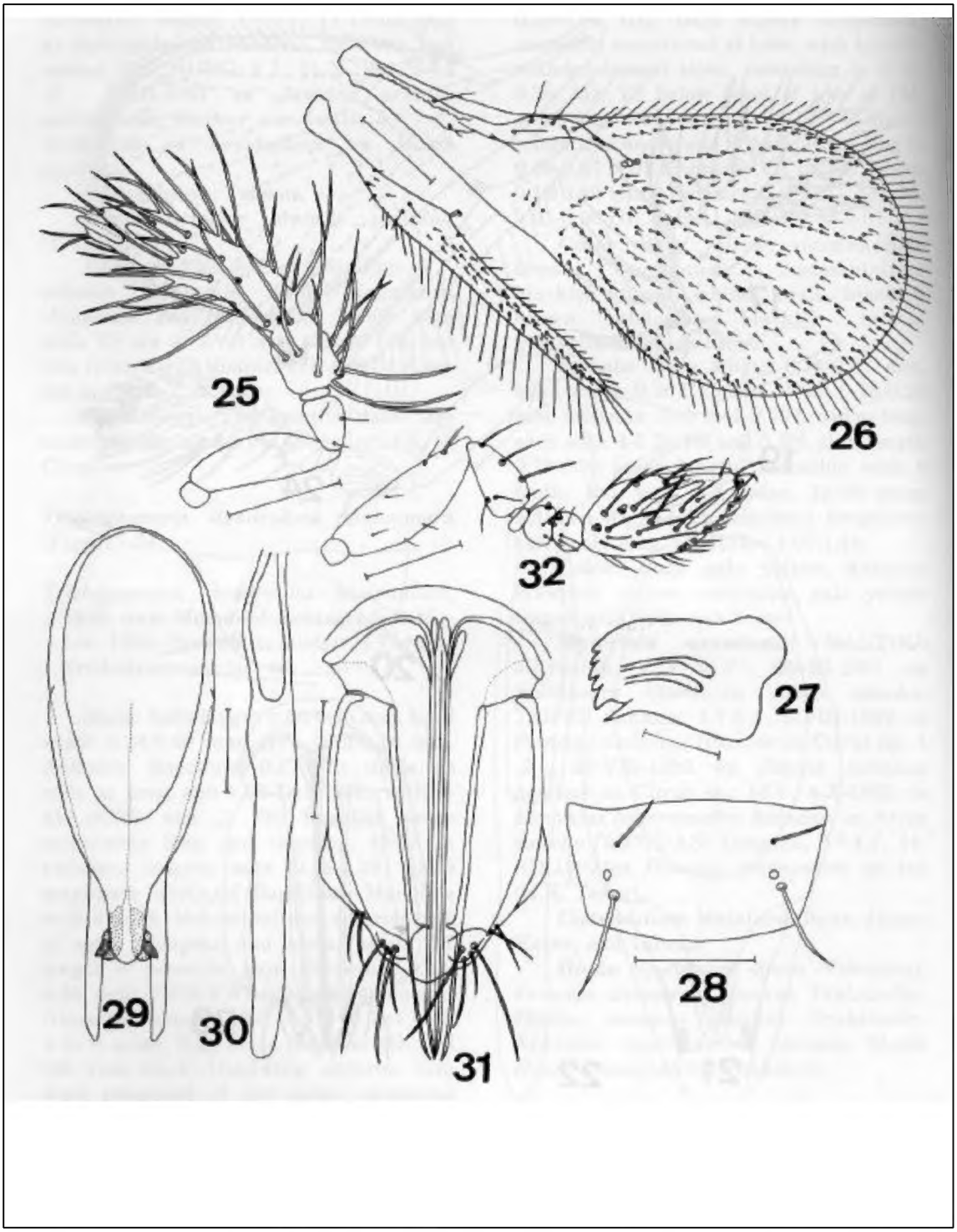

Fig.25-32. ***Tichogramma japonicum*** Ashmead: 25-30, male; 31-32, female. 25, antenna; 26, wings; 27, mandible (dorsal view); 28, mesoscutellum (expanded); 29, genital capsule (dorsal view); 30, aedeagus (dorsal view); 31, ovipositor; 32, antenna. (Scale: 27, 29, 30= 0.02 mm; 25, 28, 31, 32= 0.05 mm; 26= 0.1 mm).

J.N.Y. ent. Soc. 12: 165. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 60.

Neotrichogramma japonicum Girault, 1911, Can. Entomol. 43:192.

Male: Body length 0.55-0.75 mm, head width 0.23-0.31 mm, HTL 0.14-0.18 mm. Antenna: flagellum 0.21 times as wide as long, and slightly longer than HTL; with 9 BCPS and 3 PS; flagellar setae long and sharply tapering, 44-52 in number, longest seta 2.8 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about half length of posterior pair. Forewing: 0.47-0.60 mm, FWW/FWL= 0.45; longest fringe seta about 0.2 FWW, nearly as long as on outer margin; Rs1 with 8 to 9 setae, 23-37 setae between 4th and 5th vein track. Hindwing: anterior vein tract composed of 7-11 setae, extending more than 0.8 distance of middle tract, posterior vein tract with 11-15 setae, almost extending apex of middle tract.

Genitalia: GC 0.26 as wide as long; PM parallel and slightly convergent to apex; AD long, 0.32 GL; length of DA 0.55 GL; DLA highly sclerotized, horseshoe shaped with rounded posterior extremity, extending to 0.55 AD; VS far below level of tips of PM, occupying about 0.47-0.55 AD; IVP inconspicuous, entire region highly chitinized; IB narrow; VR paired, extending about 0.67 GL; VP not visible. Apodemes extremely short, 0.26-0.32 AL. AL as long as GL and same or slightly shorter than HTL.

Color: Head dull brownish yellow; antenna brownish yellow. Mesosomal sclerites blackish; metasomal terga blackish. Legs with hind coxa blackish. Genitalia blackish.

Female: Body length 0.67-0.91 mm, head width 0.22-0.29 mm, HTL 0.14-0.20 mm. Antenna: club 0.46-0.50 broad as long, each with 4 BCPS and 4-5 PS; club length 0.85-1.0 scape length. Mandible with 6 teeth. Forewing: Rs1 with 8 to 10 setae, 29-48 setae between 4th and 5th vein tract. Ovipositor extremely long, OL/HTL= 1.35-1.5.

Color: Same as male, but ovipositor blackish.

Materials examined: TAIPEI: 9♀ 12 ♂, VIII-1968 ex Chilo suppressalis on rice.

Distribution: Burma**,** Mainland China, French, India, Indo-China, Japan, Java, Korean, Malay, Philippines, and Taiwan.

Host: Chilo suppressalis (Walker).

Trichogramma longxishanense Lin (Figs. 33-40)

Trichogramma longxishanense Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 62.

Male: Body length 0.65-0.83 mm, head width 0.26-0.36 mm, HTL 0.15-0.19 mm. Antenna: flagellum 0.19-0.27 times as wide as long, and 0.81-1.0 HTL; with 8-10 BCPS and 3 PS; flagellar setae long and sharply tapering, 30-42 in number, longest seta 2.76-3.25 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about 0.14-0.2 length of posterior pair. Forewing: 0.47-0.62 mm, FWW/FWL= 0.52-0.54; longest fringe seta about 0.10-0.16 FWW; Rs1 with 2 to 5 setae, 4-14 setae between 4th and 5th vein tract. Hindwing: anterior vein tract without any seta, posterior vein tract with 4-7 setae, extending 0.25-0.54 of middle tract.

Genitalia: GC 0.46-0.51 as wide as long; PM and VS gradually convergent to apex, and almost combined together tightly; AD 0.24-0.27 GL; length of DA 0.59-0.67 GL; DLA not distinct, VS extremely long, and behind level of tips of PM, occupying about 1-1.12 AD; IVP rather broad and entire region highly sclerotized, about 0.74-0.82 AD, IB broad; VR almost extending to anterior margin of GB; VP not visible. Apodemes slightly

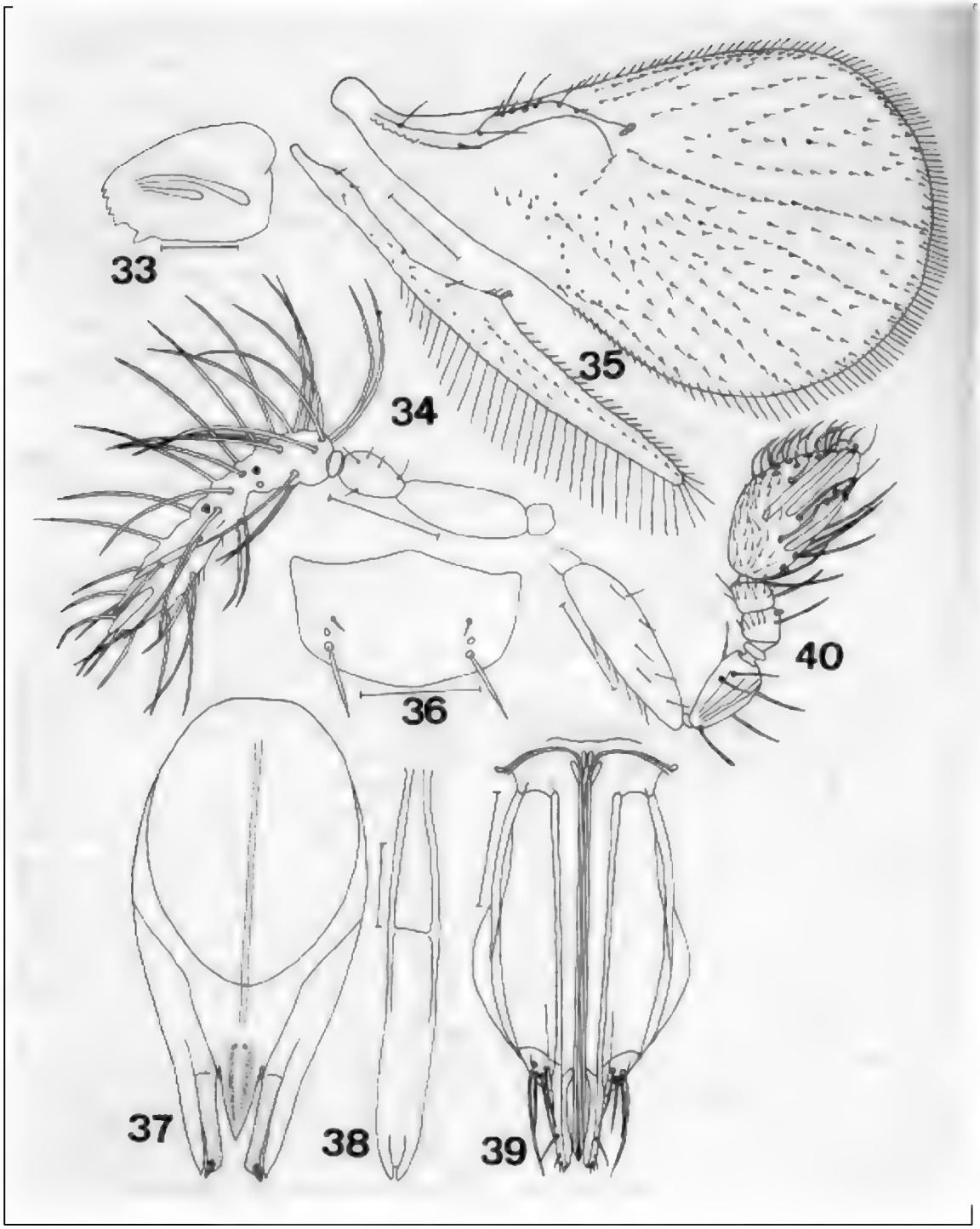

Fig. 33-40. ***Trichogramma longxishanense*** Lin: 33-38, male; 39-40, female. 33, mandible (dorsal view); 34, antenna; 35, wings; 36, mesoscutellum (expanded); 37, genital capsule (dorsal view); 38, aedeagus (dorsal view); 39, ovipositor; 40, antenna. (Scale: 33, 37, 38= 0.02mm; 34, 36, 39, 40= 0.05mm; 35= 0.1 mm).

divergent to apex, 0.37-0.48 AL. Aedeagus broad, more or less triangular, AL about 0.81-0.88 GL and AL/HTL= 0.62-0.74.

Head brownish yellow; antenna brownish yellow. Mesosomal sclerites blackish; Legs with hind coxa black, metasomal terga blackish.

Female: Body length 0.79-0.91 mm, head width 0.29-0.36 mm, HTL 0.17-0.18 mm. Antenna: club 0.48-0.50 broad as long, each with 5 BCPS and 4-5 PS; club length 0.87-0.96 scape length. Mandible with 6 teeth. Forewing: Rs1 with 3-4 setae, 8-12 setae between 4th and 5th vein tract. Ovipositor extremely long, OL/HTL= 1.61-1.67.

Color: Lighter than male, body brownish yellow. Mesosomal sclerites and metasomal terga brownish except apical half. Antenna brownish yellow. Legs with hind femur blackish.

Materials sexamined: TAIPEI: 7♀14♂, 30-XI-1991 ex Suastus gremius on Rhapis excelsa; 1♂, 21-VI-1992 ex Macroglossum pyrrhostictum on Paederia scandens var. mairei.

Distribution: Taiwan (new record), Mainland China.

Hosts: Macroglossum pyrrhostictum (Butler) and Suastus gremius (Fabricius).

Trichogramma ostriniae Pang & Chen (Figs. 41-48)

Trichogramma ostriniae Pang & Chen, 1974, Acta Entomol. Sinica 17:444. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 54.

Male: Body length 0.53-0.85 mm, head width 0.24-0.27 mm, HTL 0.15-0.16 mm. Antenna: flagellum moderately long, 0.15-0.18 times as wide as long, and 1.15-1.27 HTL; with 9 BCPS and 3 PS; flagellar setae moderately long, tapering gradually from base to near apex, 38-46 in number, longest seta 3-3.17 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: with anterior pair of setae short and fine, about 0.16-0.19 length of posterior pair. Forewing: 0.49 mm, with vein tract well defined, FWW/FWL= 0.49; longest fringe seta about 0.17 FWW; Rs1 with 3 to 4 setae, 11-19 setae between 4th and 5th vein track. Hindwing: with middle vein tract prominent and complete to apex; anterior vein tract usually absent but occasionally with one seta, extending more than 0.15-0.2 distance of middle tract, posterior vein tract with 7-9 setae widely spaced, almost extending 0.5-0.58 length of middle tract.

Genitalia: GC 0.41-0.47 as wide as long; PM parallel and slightly convergent to apex; AD 0.21-0.26 GL; length of DA 0.54-0.60 GL; DLA well sclerotized, sub-triangular, acuminate at apex, abruptly narrowed posterior to basal constriction, extending to 0.39-0.62 AD; VS nearly same level as DLA, occupying about 0.42-0.69 AD; IVP long and narrow, distinctly pointed apex and below that of DLA and VS, extending to 0.80-0.85 GL; IB narrow; VR paired, extending about 0.18-0.47 GL; VP not visible. Apodemes 0.51-0.53 AL. AL/GL= 0.97-1.07, and AL/HTL= 0.68-0.86.

Color: Body yellow; head pale yellow lightly infuscate; antenna pale brown; pronotum brown; abdomen brown; legs light yellow, with hind femur brownish yellow.

Female: Body length 0.71-0.79 mm, head width 0.24-0.31 mm, HTL 0.16-0.19 mm. Antenna: club 0.41-0.49 broad as long, each with 5 BCPS and 4-5 PS; club length 0.81-0.91 scape length. Mandible with 6 teeth. Forewing: Rs1 with 4-7 setae, 14-32 setae between 4th and 5th vein tract. Ovipositor: OL/HTL= 0.98-1.05.

Color: Similar to male, but lighter than male. Body pale yellowish brown, anntenna pale brown, head pale yellowish brown. Mesoscutellum brown, abdomen yellowish brown.

Materials examined: CHANGHUA: 1♀2♂, 26-VIII-1991 ex Agrius convolvuli on Colocasia antiquorum var. esculenta.

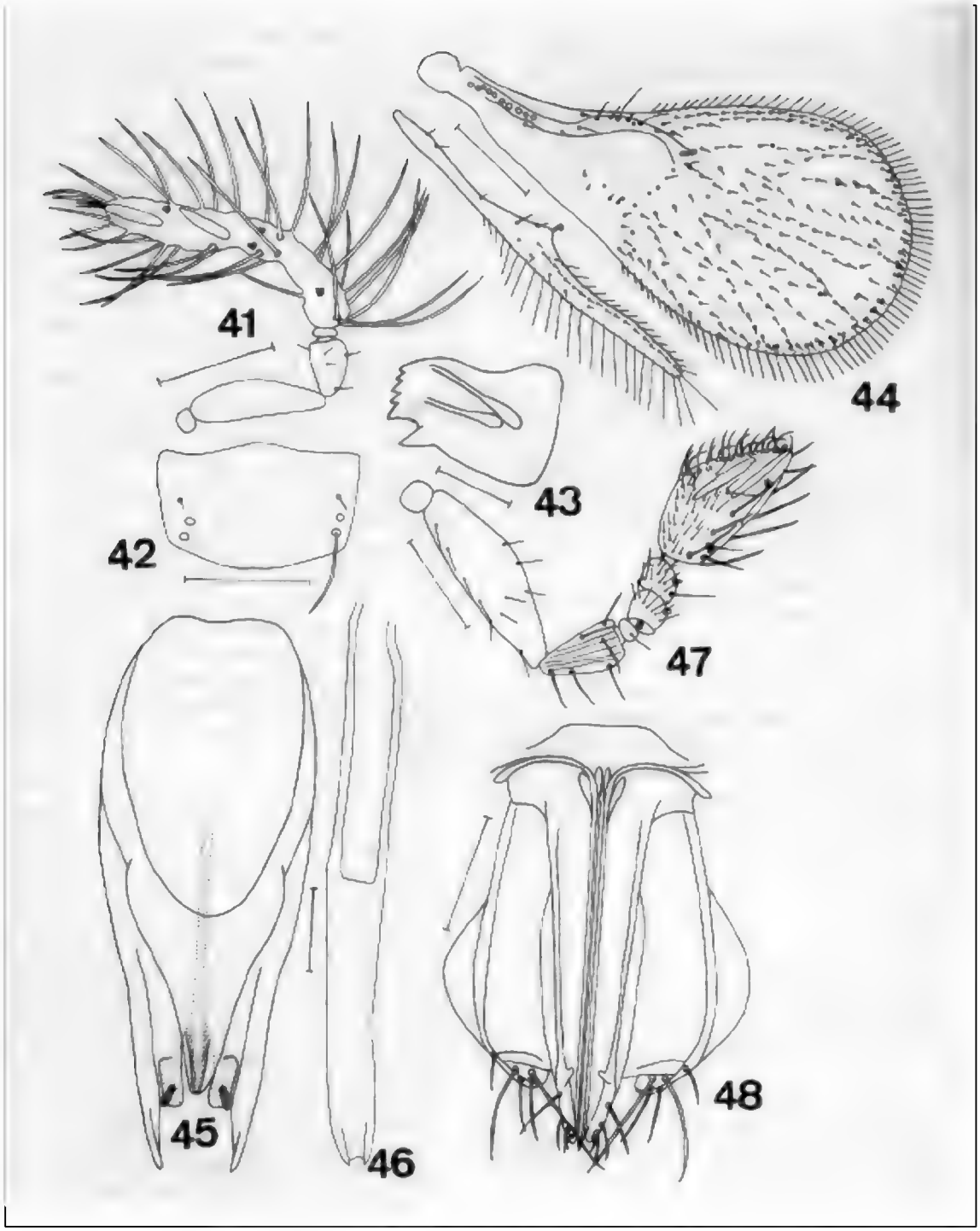

Fig. 41-48. ***Trichogramma ostriniae*** Pang & Chen: 41-46, male; 47-48, female. 41, antenna; 42, mesoscutellum (expanded); 43, mandible (dorsal view); 44, wings; 45, genital capsule (dorsal view); 46, aedeagus (dorsal view); 47, antenna; 48, ovipositor. (Scale: 43, 45, 46= 0.02mm; 41, 42, 47, 48= 0.05mm; 44= 0.1 mm).

TAICHUNG: Wufeng, 10 ♀ 11 ♂, 23-VI-1992 ex Ostrinia furnacalis on Zea mays; 9 ♀ 21 ♂, 30-VI-1993 ex Pyralidae on Solanum melongena. TAINAN: 3♀ 16♂, 23-VIII-1991 ex Ostrinia furnacalis on Zea mays.

Distribution: Mainland China, Hawaii, and Taiwan.

Hosts: Ostrinia furnacalis (Guenee).

Trichogramma raoi Nagaraja (Figs. 49-56)

Trichogramma raoi Nagaraja, 1973, Oriental Insects 7: 279. - Lin, 1994, Systematic studies of Chinese Trichogrammatidae: 58.

Male: Body length 0.50-0.55 mm, head width 0.20-0.22 mm, HTL 0.11-0.14 mm. Antenna: flagellum 0.14-0.17 times as wide as long, and 1.14-1.25 HTL; with 8-10 BCPS and 3 PS; flagellar setae long and tapering, 37-44 in number, longest seta 2.8-3.3 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae elongate and stout, about 0.2-0.24 length of posterior pair. Forewing: 0.35-0.42 mm, FWW/FWL= 0.45-0.5; longest fringe seta about 0.13-0.2 FWW; Rs1 with 2 to 5 setae, 9-27 setae between 4th and 5th vein tract. Hindwing: anterior vein tract composed of 0-2 setae, extending more than 0.29-0.37 distance of middle tract, posterior vein tract with 4-8 setae, extending 0.4-0.56 middle tract.

Genitalia: GC 0.36-0.40 as wide as long; AD 0.22-0.26 GL; length of DA 0.55-0.63 GL; DLA very narrow, weakly sclerotized with acute posterior extremity, and far below level of VS, extending to 0.5-0.65 AD; VS slightly below level of PM, occupying about 0.71-0.8 AD; IVP inconspicuous; IB narrow; VR apparently single, extending nearly to anterior margin of GB; with 2 VP distinct. Apodemes 0.42-0.56 AL, AL 0.75-0.92 GL and AL/HTL= 0.68-0.85.

Color: Body brownish yellow; pronotum, mesonotum, pleurae, abdomen, and coxae blackish.

Female: Body length 0.55-0.78 mm, head width 0.21-0.28 mm, HTL 0.14-0.17 mm. Antenna: club 0.37-0.41 broad as long, each with 4-5 BCPS and 5 PS; club length 0.44-0.47 scape length. Mandible with 6 teeth. Ovipositor long, OL/HTL= 1.0-1.06.

Color: Same as male, abdomen yellowish at apex.

Materials examined: NANTOU: Huisun, 2♀, 28-X-1992 ex Trichoplusia ni on Bidens pilosa var. minor. TAICHUNG: Wufeng, 1♂, 26-II-1992; 10♀ 4♂, 28-II-1992; 1♂, 14-X-1992; 5♀1♂, 15-X-1992; 7 ♀1♂, 19-X-1992; ex Trichoplusia ni on Boehmeria frutescens var. frutescens; 2♀ 4♂, 20-III-1992 ex Acraea issoria on Boehmeria frutescens var. frutescens; 1♀ 1♂, 30-III-1992 ex Trichoplusia ni on Brassica oleracea var. capitata; 1♀ 1♂, 23-IV-1992 ex Trichoplusia ni on Ageratum conyzoides.

Distribution: India, Mainland China, and Taiwan (new record).

Hosts: Acraea issoria formosana (Fruhstorfer) and Trichoplusia ni (Hubner).

Trichogramma taiwanense n. sp. (Figs. 57-64)

Male: Body length 0.64-0.73 mm, head width 0.25-0.30 mm, HTL 0.13-0.16 mm. Antenna: flagellum 0.14-0.18 times as wide as long, and 1.25-1.38 HTL; with 9-10 BCPS and 3 PS; flagellar setae long and tapering, 37-54 in number, longest seta 2.5-3.16 times maximum width of flagellum. Mandible with 6 teeth. Mesoscutellum: anterior pair of setae short and fine, about 0.19-0.28 length of posterior pair. Forewing: 0.46-0.54 mm, FWW/FWL= 0.51-0.55; longest fringe seta about 0.14-0.17 FWW; Rs1 with 3 to 5 setae, 4-13 setae between 4th and 5th vein tract. Hindwing: anterior vein tract usually absent but occasionally with one setae, extending about 0.61 distance of middle tract, posterior vein tract with 4-9

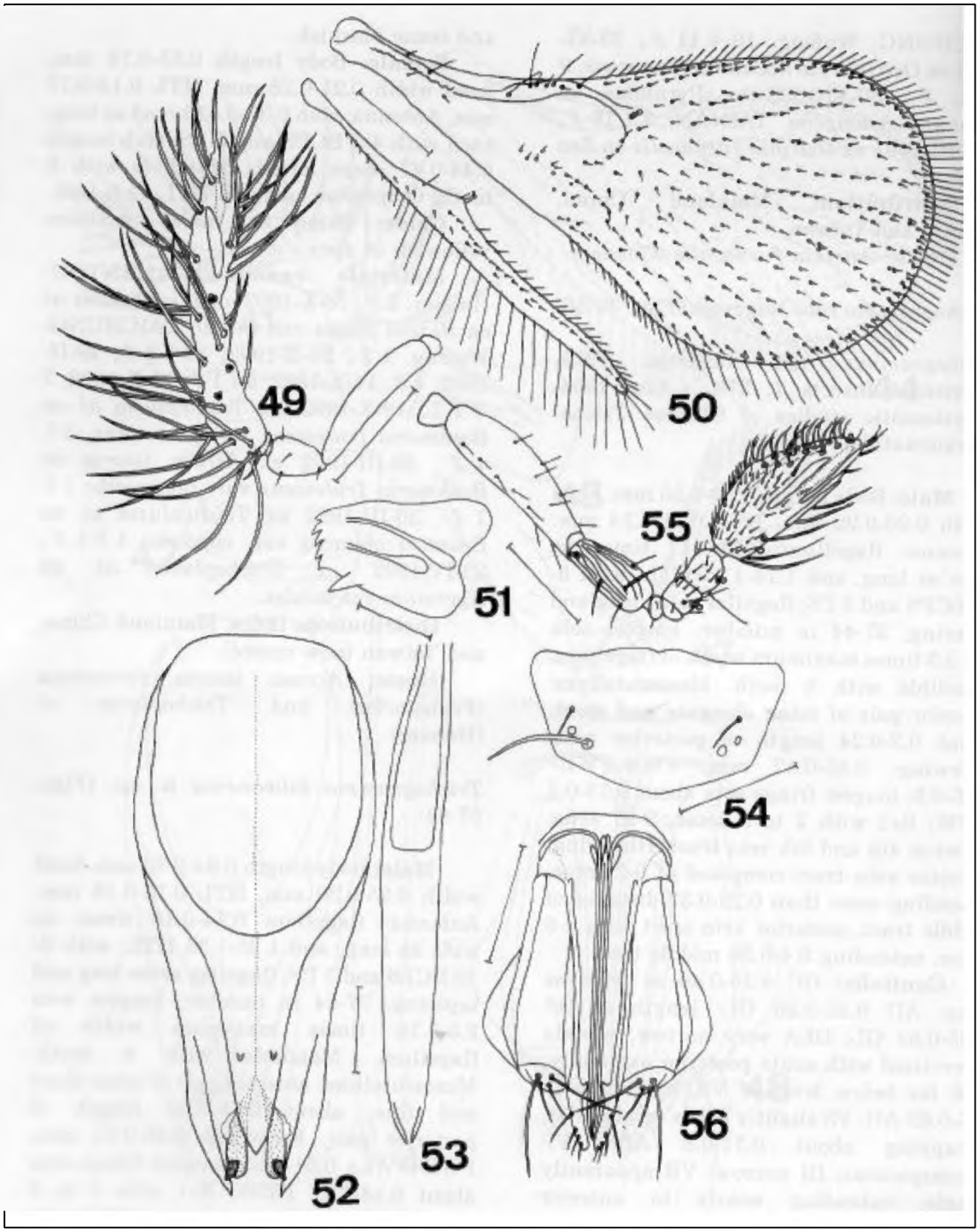

Fig. 49-56. ***Trichogramma raoi*** Nagaraja: 49-54, male; 55-56, female. 49, antenna; 50, wings; 51, mandible (dorsal view); 52, genital capsule (dorsal view); 53, aedeagus (dorsal view); 54, mesoscutellum (expanded); 55, antenna; 56, ovipositor. (Scale: 51, 52, 53= 0.02mm; 49, 54, 55, 56= 0.05mm; 50= 0.1 mm).

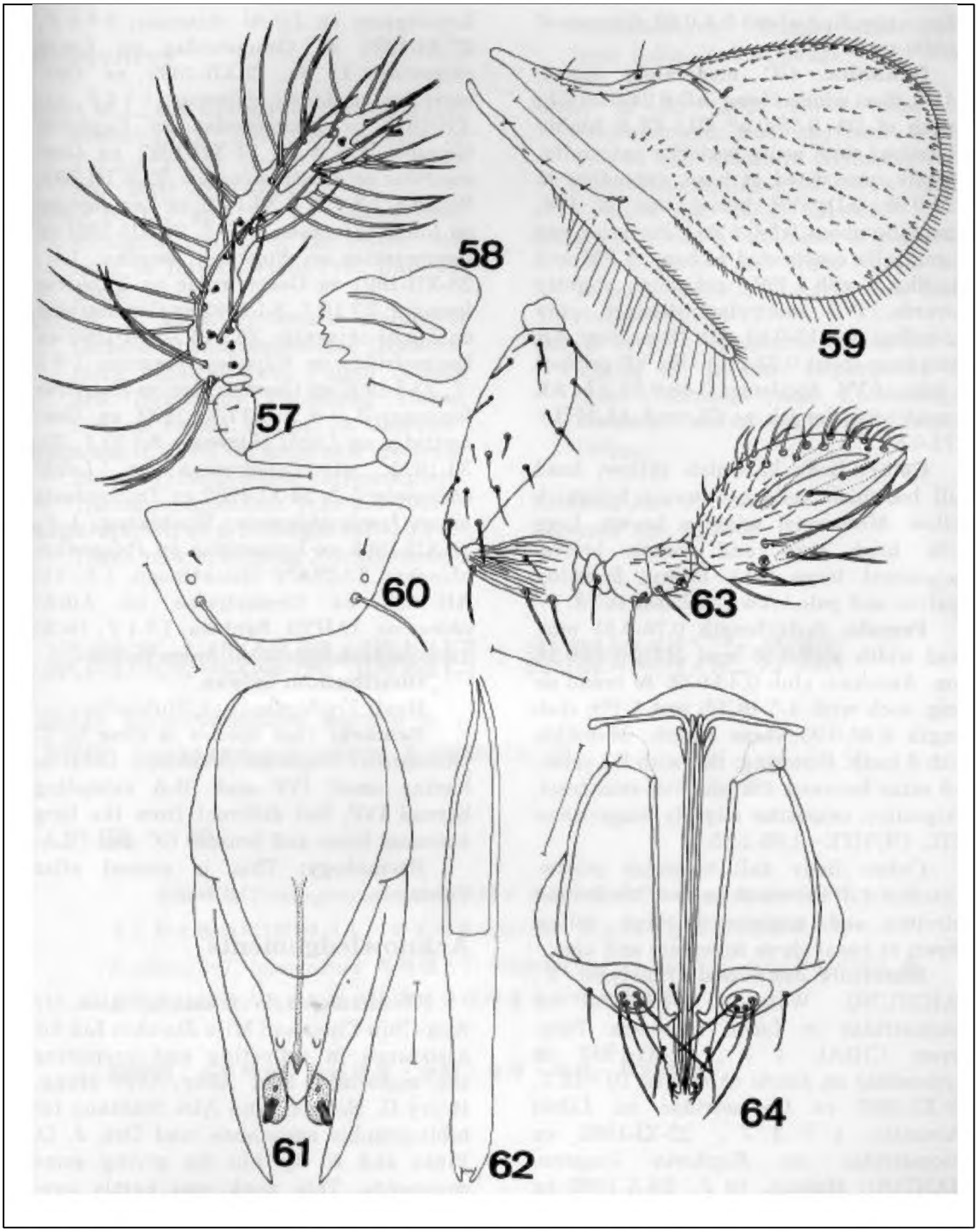

Fig. 57-64. ***Trichogramma taiwanense* n. sp.:** 57-62, male; 63-64, female. 57, antenna; 58, mandible (dorsal view); 59, wings; 60, mesoscutellum (expanded); 61, genital capsule (dorsal view); 62, aedeagus (dorsal view); 63, antenna; 64, ovipositor. (Scale: 58, 61, 62= 0.02mm; 57, 60, 63, 64= 0.05mm; 59= 0.1 mm).

setae, extending about 0.4-0.69 distance of middle tract.

Genitalia: GC moderately broad, 0.41-0.45 as wide as long; AD 0.24-0.29 GL; length of DA 0.53-0.58 GL; DLA highly sclerotized with acute posterior extremity, slightly constricted at base, extending to 0.22-0.38 AD; VS below tips of PM, occupying about 0.5-0.6 AD; Posterior end of genitalia constricted at base of PM and cup-like, with PM pointing slightly inwards. IVP short but distinct, only extending to 0.13-0.21 AD; IB narrow; VR extending about 0.32-0.71 GL; VP present at base of VS. Apodemes 0.48-0.52 AL, AL almost same length as GL and AL/HTL= 0.72-0.81.

Color: Body brownish yellow; head dull brownish yellow; antenna brownish yellow. Mesosomal sclerites brown. Legs with hind coxa and femur brown, metasomal terga dark brown; forewing hyaline and pale brown at basal third.

Female: Body length 0.73-0.81 mm, head width 0.26-0.36 mm, HTL 0.16-0.18 mm. Antenna: club 0.48-0.56 as broad as long, each with 4-5 BCPS and 5 PS; club length 0.86-0.93 scape length. Mandible with 6 teeth. Forewing: Rs1 with 2-4 setae, 5-8 setae between 4th and 5th vein tract. Ovipositor: ovipositor slightly longer than HTL, OL/HTL= 1.06-1.15.

Color: Body dull brownish yellow. Antenna dull brownish yellow. Mesosomal sclerites and metasomal terga yellow brown at basal three segments and apex.

Materials examined: Holotype: ♂, TAICHUNG: Wufeng, 17-XI-1992 ex Geometridae on Litchi chinensis. Paratypes: CHIAI: 1 ♂, 22-XI-1992 ex Lycaenidae on Litchi chinensis; 10♀15♂, 22-XI-1992 ex Geometridae on Litchi chinensis; 1 ♀ 3 ♂, 22-XI-1992 ex Geometridae on Euphoria longana. NANTOU: Huisun, 13 ♂, 28-X-1992 ex Lepidoptera on weed; Tsaotun, 3♀21♂, 4-XI-1992 ex Lepidoptera on Litchi chinensis; 2♀, 13-XI-1992 ex Geometridae on Litchi chinensis; 7♀26♂, 19-XI-1992 ex Lepidoptera on Litchi chinensis; 3♀6♂, 27-XI-1992 ex Geometridae on Litchi chinensis; 11 ♂, 2-XII-1992 ex Geometridae on Litchi chinensis; 1♀4♂, 31-XII-1992 ex Geometridae on Euphoria longana; 1♀2♂, 31-XII-1992 ex Geometridae on Litchi chinensis. TAICHUNG: Wufeng, 1♀1♂, 7-XI-1991 ex Lepidoptera on Litchi chinensis; 2♀3♂, 26-XII-1991 ex Geometridae on Euphoria longana; 1♀, 28-XII-1991 ex Geometridae on Euphoria longana; 2♀10♂, 8-I-1992 ex Geometridae on Litchi chinensis; 26♀14♂, 8-I-1992 ex Geometridae on Euphoria longana; 1♀1♂, 23-I-1992 ex Geometridae on Euphoria longana; 3♀6♂, 17-XI-1992 ex Geometridae on Litchi chinensis; 8♀10♂, 20-XI-1992, ex Lepidoptera on Litchi chinensis; 7♂, 24-XI-1992 ex Trichoplusia ni on Ixeris chinensis; Wushikeng, 1♂, 18-XII-1992 ex Lycaenidae on Polygonum chinense. TAINAN: Hsientsaopu, 1♂, 11-XII-1992 ex Geometridae on Litchi chinensis. TAIPEI: Sanhsia, 1♀1♂, 16-X-1992 ex Lepidoptera on Areca catechu.

Distribution: Taiwan.

Host: Trichoplusia ni (Hubner).

Remark: This species is close to T. plasseyensis Nagaraja (Nagaraja, 1973) in having small IVP and DLA extending beyond IVP, but different from the long antennal hairs and broader GC and DLA.

Etymology: This is named after Taiwan.

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臺灣產赤眼蜂屬(膜翅目：赤眼蜂科)之分類

詹美鈴　國立自然科學博物館動物學組　臺中市館前路一號

周樑鎰*　行政院農業委員會農業試驗所應用動物系　臺中縣霧峰鄉中正路 189號

摘　要

赤眼蜂屬(Trichogramma)隸屬膜翅目、赤眼蜂科(Trichogrammatidae)，全世界已知之種類約150種以上，而臺灣僅記錄6種。本文記述臺灣產之8種赤眼蜂，其中T. choui 和T. taiwanense 為新種，T. longxishanense Lin 和T. raoi Nagaraja 為臺灣新記錄種。此外，並附臺灣產赤眼蜂屬已知種之檢索表。

關鍵詞：赤眼蜂科、赤眼蜂屬、分類、臺灣、新種、新記錄種。